

8.2 Cell Respiration

Question Paper

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| Course | DP IB Biology |
| Section | 8. Metabolism, Cell Respiration & Photosynthesis (HL Only) |
| Topic | 8.2 Cell Respiration |
| Difficulty | Medium |

Time allowed: 60
Score: /49
Percentage: /100

Question 1a

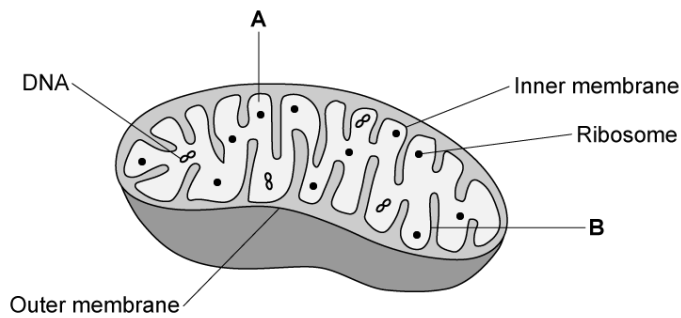
a)
Mitochondrial diseases in humans cause their mitochondria to malfunction. Individuals that suffer from mitochondrial disease are only able to endure intense exercise for a short period of time.

Explain why this is.

[2 marks]

Question 1b

b)
The diagram below shows a mitochondrion.

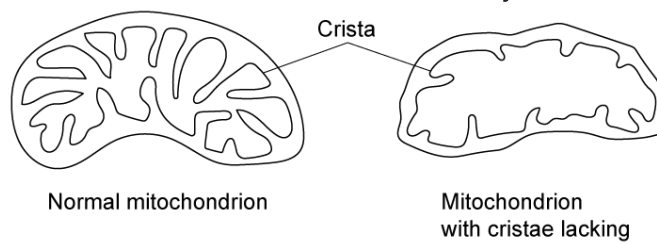


Identify the structures labelled **A** and **B** in the diagram

[1 mark]

Question 1c

c)
Some forms of mitochondrial dysfunction result in mitochondria that lack fully formed cristae as shown in the diagram below.

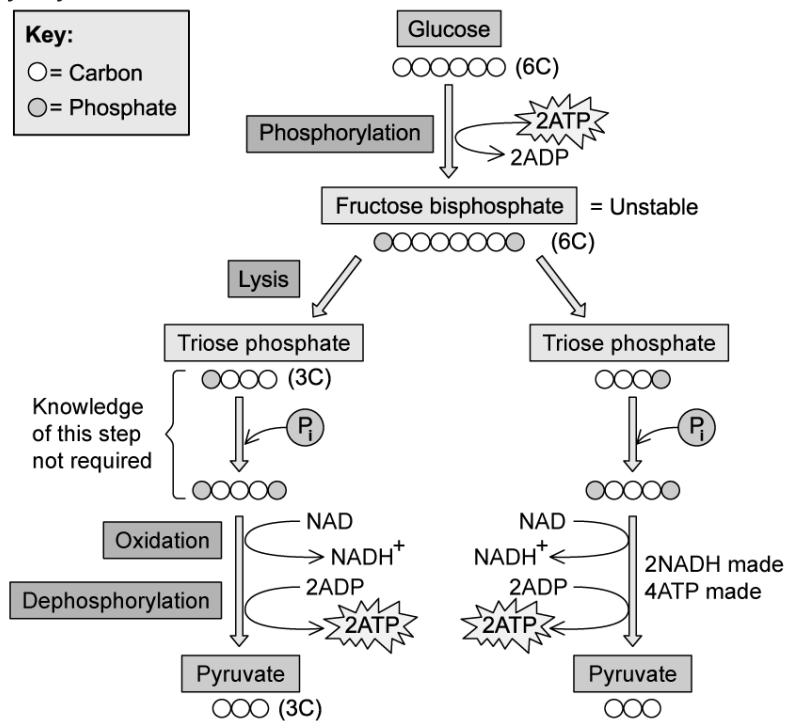


Suggest, with a reason, the effect of this on the production of ATP.

[3 marks]

Question 1d

d)
The diagram below shows glycolysis.



State the net production of ATP and reduced NAD during glycolysis.

[1 mark]

Question 2a

a)
The Krebs cycle, which takes place in the mitochondrial matrix, releases hydrogen ions. These hydrogen ions provide a source of energy for the synthesis of ATP, using coenzymes.

Describe the role of the coenzymes in the synthesis of ATP.

[3 marks]

Question 2b

b)

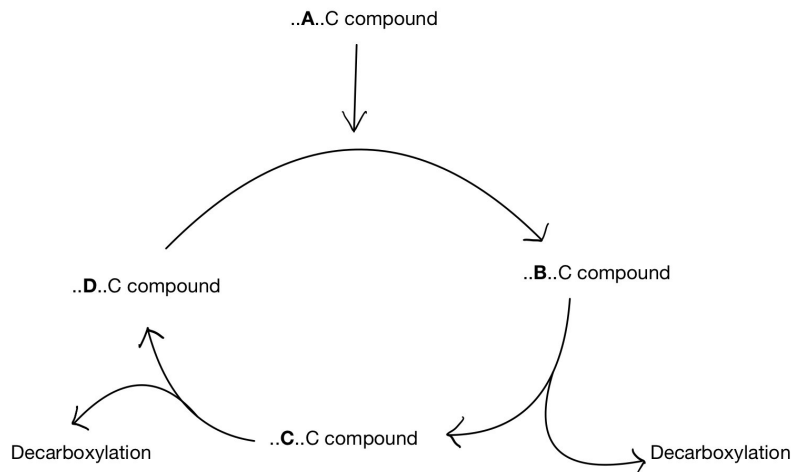
Explain why the link reaction is described as an oxidative decarboxylation reaction.

[2 marks]

Question 2c

c)

The diagram below shows the Krebs cycle.



Identify the number of carbon atoms (e.g. 1C) at each stage of the Krebs cycle.

[2 marks]

Question 2d

d)

NAD and FAD are important electron carriers produced throughout the stages of respiration.

Complete the table below to show how many molecules of NAD and FAD are produced at each stage per molecule of glucose.

| Stage of respiration | Number of NAD molecules | Number of FAD molecules |
|--------------------------|-------------------------|-------------------------|
| Glycolysis | | |
| Link reaction | | |
| Krebs cycle | | |
| Electron transport chain | | |
| Chemiosmosis | | |

[2 marks]

Question 3a

a)

Describe the role of oxygen in respiration.

[3 marks]

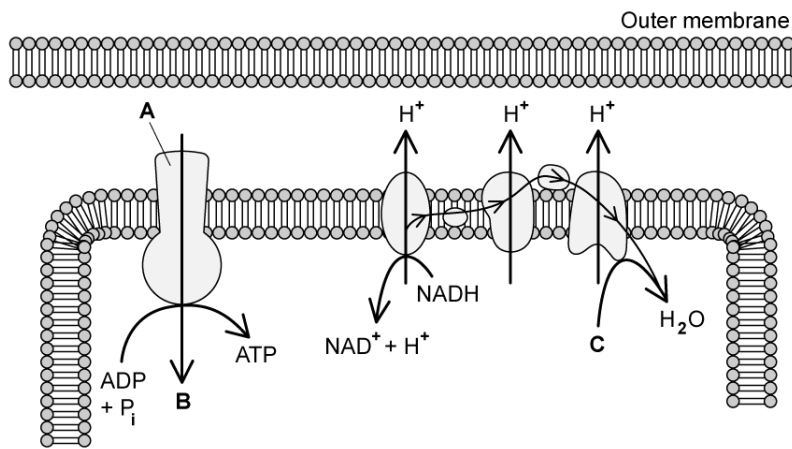
Question 3b

b)
Outline the events of the electron transport chain.

[3 marks]

Question 3c

c)
The diagram below shows part of a mitochondrion.



Suggest, with a reason, which part of the mitochondrion is shown in the diagram.

[2 marks]

Question 3d

d)
Label parts **A**, **B** and **C** in the diagram in part c).

[1 mark]

Question 4a

a)

Draw an annotated diagram of a mitochondrion as seen through an electron microscope.

[3 marks]**Question 4b**

b)

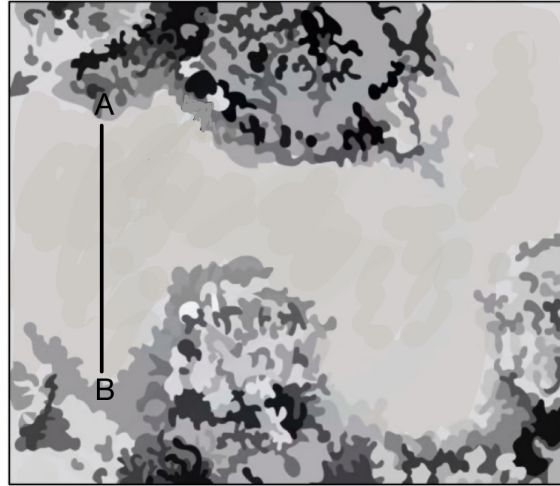
Electron tomography has been used to make new discoveries about mitochondria.

Describe features of the mitochondria that have been identified by the use of electron tomography.

[2 marks]

Question 4c

c)
The diagram below shows the cristae of a mitochondrion viewed with a magnification of $\times 7000$.



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Use the information from the diagram and above to calculate the actual size space between **A** and **B**.

[1 mark]

Question 4d

d)
Phosphorylation occurs on the cristae membrane.

- i. Describe the process of phosphorylation of ATP.
- ii. State the stage(s) of respiration in which substrate level phosphorylation occurs.

[3 marks]

Question 5a

One mark is available for clarity of communication throughout this question.

a)

Describe the mechanism by which ATP is formed in the mitochondria.

[8 marks]

Question 5b

b)

In the 1960s Peter Mitchell developed the theory of chemiosmosis which was a novel idea from the current theories.

Outline the key principles of his hypothesis that made it a paradigm shift.

[4 marks]

Question 5c

c)

Explain the relationship between the structure of the mitochondria and how it's related to its function.

[3 marks]